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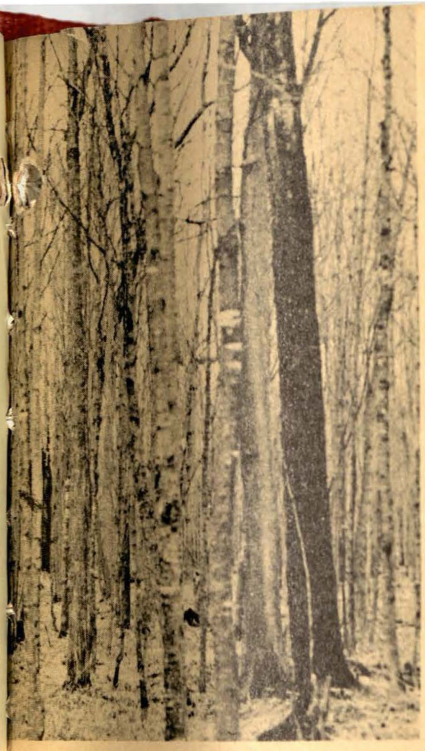
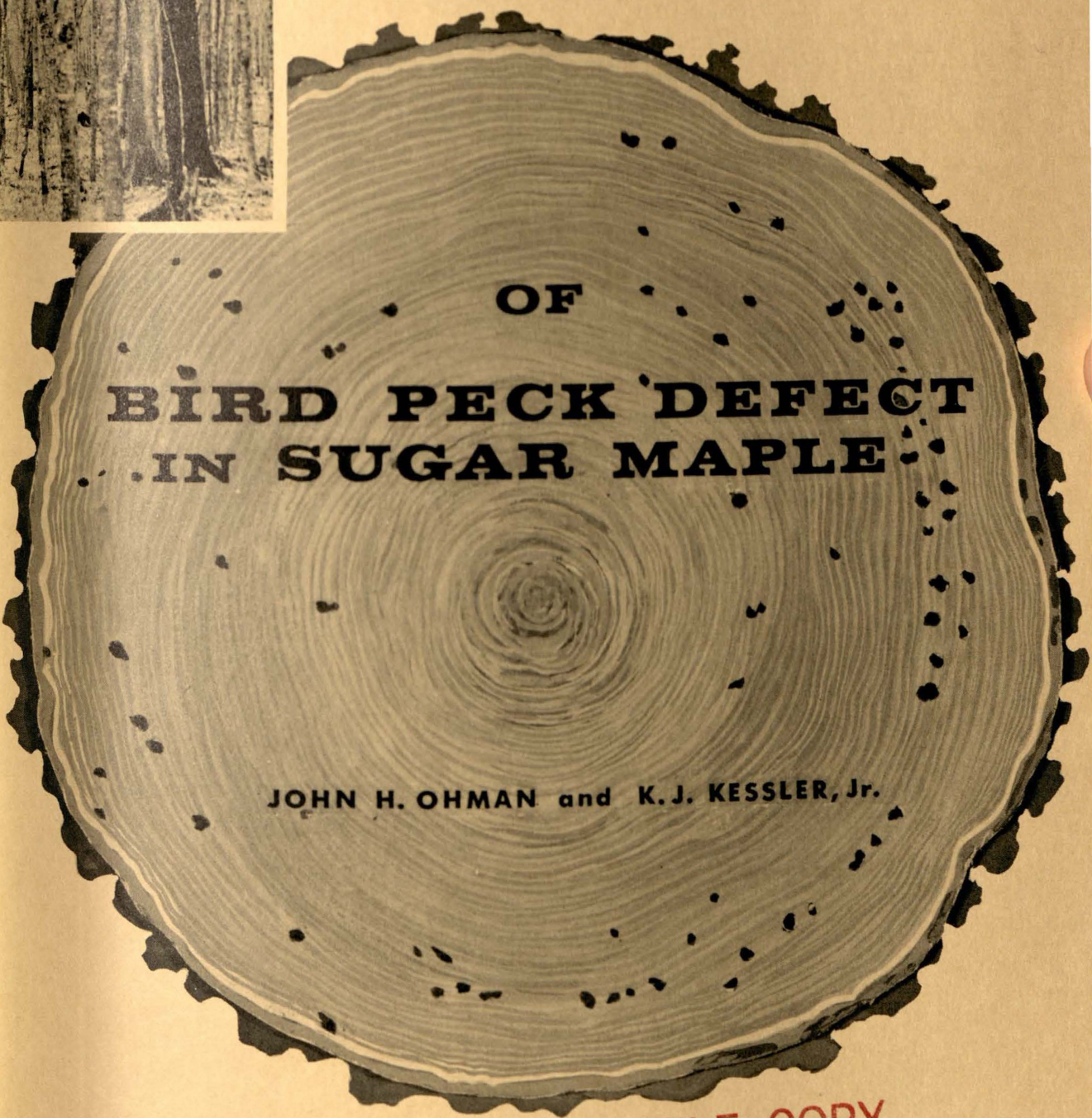


BLACK BARK AS AN INDICATOR OF BIRD PECK DEFECT IN SUGAR MAPLE



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Introduction

Portions of the lower bole of occasional sugar maples (*Acer saccharum* Marsh.) in Lake States northern hardwood stands are sooty black in sharp contrast to the normal gray (fig. 1). The blackened areas may encircle the entire stem or be confined to a narrow band; they have been observed as high as 25 feet but generally extend about 15 feet above the ground. Preliminary investigations indicated that nearly all such trees had been heavily and repeatedly attacked by sapsuckers. The possibility of using the black bark as an external indicator of bird peck defect in sugar maple prompted this investigation.

Black-barked trees are usually more abundant in lowland hardwood areas adjacent to swamps, probably because of the sapsucker's preference for these areas as nesting sites. In one lowland hardwood stand sampled, 8.7 percent of 150 sugar maples on 12 fifth-acre plots had sapsucker-caused black bark; in a nearby upland hardwood stand 1.4 percent of 297 sugar maples on 12 fifth-acre plots had sapsucker-caused black bark. The prevalence of black bark in stands throughout the Lake States is not known. "Walk-through" observations of many stands by the authors, however, indicate that the condition may be absent, or nearly so, in some upland hardwood stands while in many lowland stands the condition occurs so commonly that one is scarcely ever out of sight of a black-barked tree.

Cause of Discoloration

The sooty appearance is caused by the growth of a fungus complex on the bark surface. Most of the fungi comprising the hyphal mass have dark-colored mycelium and spores which appear dull black to the unaided eye. Fungi identified to date include *Fumago* sp. (probably the imperfect stage of *Capnodium*) and *Pullularia pullulans*. In addition, several other fungi have either been observed microscopically on sections of bark or cultured but have not yet been identified. Ellis and Everhart (1892) list *Capnodium expansum* Berk. and Desm. on black maple (*Acer nigrum* Michx. f.) in Ohio.

In many respects this condition appears similar to the "sooty mold" reported on leaves of various hardwoods and conifers following attack by aphids and scale insects (Boyce 1961). Fraser (1933, 1937), working with sooty molds on various plants in Australia, found complexes of various species of Capnodiaceae, Atichiaceae, and Fungi Imperfecti responsible for the sooty appearance and reported that such fungi were always associated with and growing on the sugary excretions of aphids and scale insects.

The black-bark condition on sugar maple differs in two major respects from the "sooty mold" of hardwoods. First, black bark occurs on the bole, usually on the lower portion, and not on the leaves or twigs; secondly, it is not associated with insect attacks but apparently follows either wounding by sapsuckers, porcupines, and small rodents or frost cracking with subsequent release during early spring of large quantities of sap containing a relatively higher sugar concentration. The sap saturates the dead bark, providing a food base for the fungi.

Incitants

Examination of hundreds of black-barked sugar maples revealed several main incitants, all of which involve wounding and subsequent release of sap on the bark.

Sapsuckers

Sapsucker wounding during early spring is the most important incitant of black bark. The wound pattern, part of the tree attacked, and time of wounding on black-barked trees differ from that described in the northeast by Shigo (1963) on sugar maple, red maple, paper birch, yellow birch, and beech, and in Minnesota by Roberts (1936) on sugar maple, red maple, and poplar. In that type, the sapsuckers make a concentrated attack in a relatively small area on large branches or on the

FIGURE 1. — Two black-barked sugar maples in a second-growth stand. Both trees have been heavily and repeatedly attacked by sapsuckers. F-506683

bole at the base of the crown. According to Roberts (1936), the usual practice is for a pair to select several trees close together and near the nesting site, tapping these repeatedly to keep sap flowing throughout the summer and early fall. Young are brought to these trees to feed later in the season. Roberts states, "The birds are in the habit of returning year after year to the same places." Localized death of the cambium often results or, in some cases, death of a portion of the crown when the limb is completely girdled. Damage of this type has also been observed in stands where black-barked trees were found and is a minor causal agent in the dieback complex of northern hardwoods.

Sapsucker attacks on black-barked sugar maple are not as concentrated (many trees observed last spring had only a single horizontal line of fresh pecks) and are generally confined to the lower portions of the bole. They are apparently made only in early spring since no freshly made wounds have been observed after mid-May. Evidences of older sapsucker attack are present in the blackened bark but are very difficult to detect from distances of more than a few feet (fig. 2).

It has been reported (Pearson 1936) that males precede females in migration and that during this period their diet consists mainly of sap. At this time the birds may actually become drunk through drinking fermented sap (Sutton 1928, Pearson 1936). Because of the differences in timing, pattern, and portion of the tree attacked between black-barked sugar maple and the birds' usual "orchard trees," it seems possible that only male sapsuckers are responsible for the attacks on black-barked sugar maples and that after nesting begins the black-barked trees are abandoned for the usual "orchard trees."

Field observations on April 23, 1963, revealed many fresh sapsucker wounds on black-barked trees.[1] Sap was flowing heavily from these wounds, saturating the bark for several feet below. All black-barked trees examined at this time also had heavy concentrations of older, nonflowing sapsucker wounds on the lower part of the bole.

Several nearby sugar maples with normal gray bark were examined near each black-barked tree. One gray-barked tree had a single fresh sapsucker wound and sap was flowing from it. A few showed evidence of scattered older sapsucker wounds, but their concentration did not approach the density on black-barked trees. Most gray-barked trees showed no evidence of sapsucker attack.

[1] *Wood (1943) reported an average arrival date in the last week of April for yellow-bellied sapsuckers in the Upper Peninsula of Michigan, but they have been observed as early as April 15.*

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FIGURE 2. — Older sapsucker wounds on a black-barked sugar maple. A row of pecks extends across the stem from the pencil point. Such wounds are difficult to see at distances of more than a few feet.

Twenty black-barked sugar maples showing evidence of bird peck were felled, dissected, and examined for evidence of earlier attack by sapsuckers. These trees ranged from 3.6 to 21.7 inches d.b.h., averaging 13.9 inches. Most were in the 100- to 150-year class. All showed evidence of heavy and repeated attack, the oldest peck noted being made 128 years previously in a 200-year-old tree as determined by ring counts. The cross-section shown in figure 3 is typical of patterns found in the larger trees examined. In all trees, the first 16-foot log had a heavy concentration of pecks and their associated stain, and in several of the larger trees so did the second 16-foot log.

One possible explanation for the striking preference of the sapsuckers for the black-barked trees is that sap from these individuals might have a higher sugar content. Variations in the sugar content of maple sap between individual trees have been reported by Taylor (1956). To test this hypothesis, 10 pairs, consisting of one black-barked and one nearby gray-barked sugar maple of approximately the same size and condition, located in three different stands, were selected and tapped with a single hole on May 2. Approximately 1 liter of sap was collected from each tree, returned to the laboratary, and frozen at -16° C. until analyzed for sugar content with a hand refractometer (Lafayette model F-358). Differences in percentages of sugar were not significant, the sap from black-barked trees averaging 2.1 percent sugar and that from normal trees 2.0 percent. Thus, the hypothesis that higher sugar content is responsible for the birds' preference is not supported by this experiment. Since the sap was collected rather late in the season, it is possible that significant differences may occur earlier. Other contributing factors may be differences in time of beginning sap flow, volumes released, and duration of flow.

Porcupines

One tree was found which had been badly damaged by porcupines working in the lower crown for more than 1 year. The main stem below the crown was completely black. Only two sapsucker pecks were found on this tree.

Small Rodents

Many small-diameter (less than 3 inches d.b.h.) sprouts arising near the ground line of mature gray-barked sugar maples were completely blackened (fig. 4). Numerous small wounds on the stems and branches, apparently made by small rodents, perhaps red squirrels, were observed (figs. 4 and 5). Early spring observations revealed many fresh

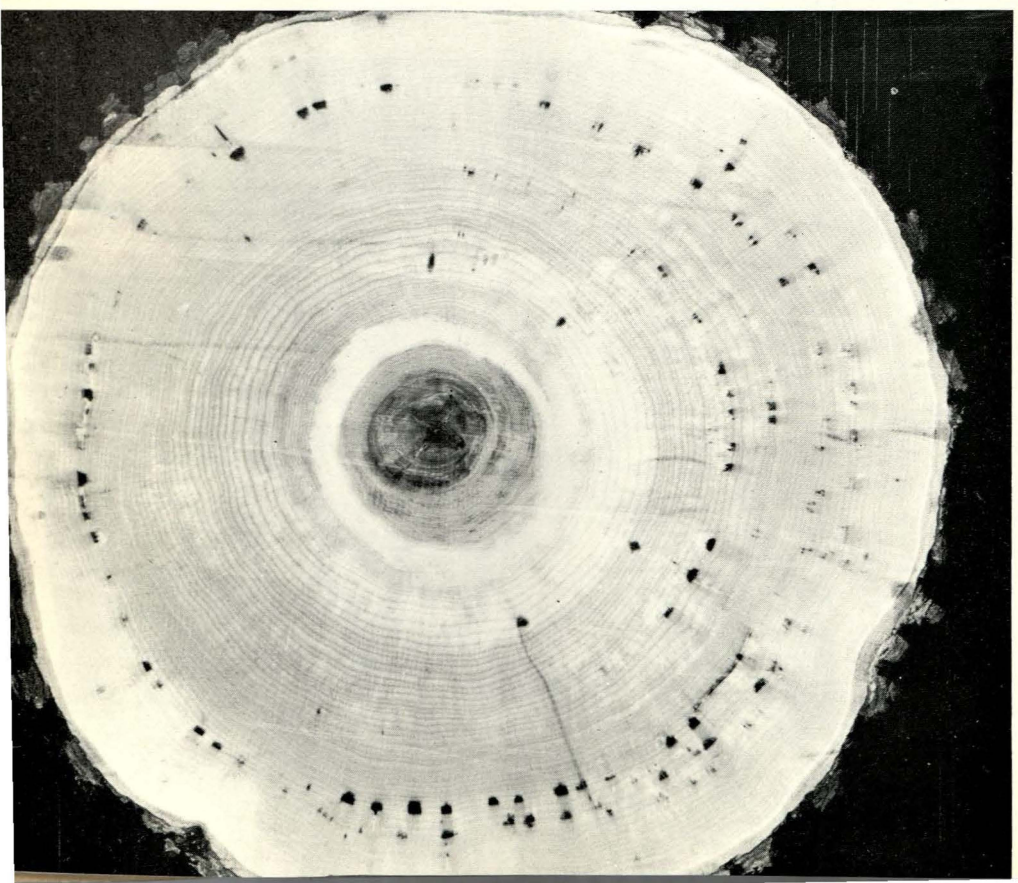

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FIGURE 3. — Bird peck defect as seen in cross section of a 19-inch d.b.h., black-barked sugar maple. Each dark stain is associated with a sapsucker wound. In this section the oldest wound was made 53 years previously. Total age at the section — 125 years.

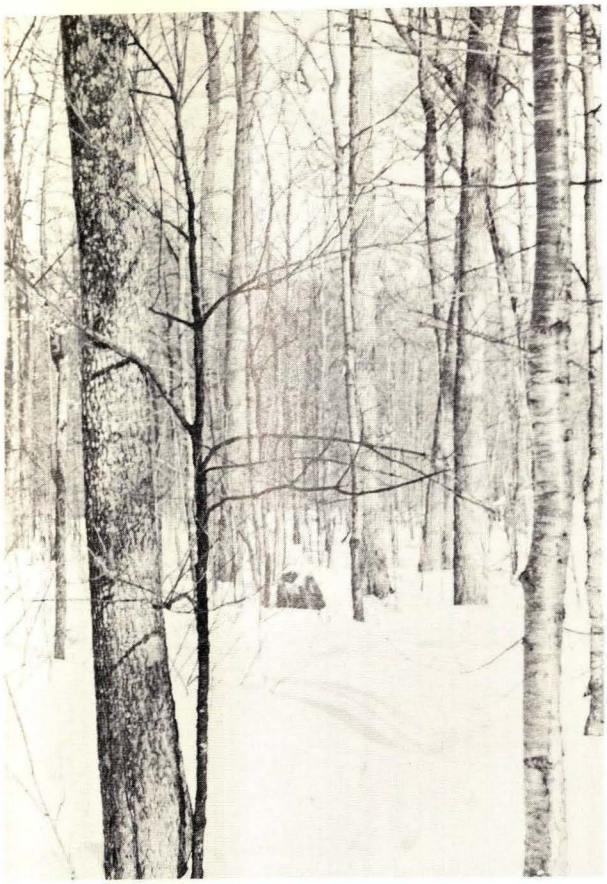

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FIGURE 4. — Black-barked sugar maple basal sprout arising from a normal tree. Repeated chewing by small rodents, probably red squirrels, is the incitant on black-barked sprouts.

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FIGURE 5. — Close-up of a portion of the sprout shown in figure 4. Gnarled appearance is due to callusing of older small rodent wounds. Younger wounds are also visible.

wounds from which the sap was flowing freely. No sapsucker wounds were observed on the sprouts.

All small rodent attacks were confined to basal sprouts; nearby seedlings and saplings were not attacked. The reasons for this preference by rodents are not known, but the fact that sprouts are connected with much larger root systems and crowns than those of seedlings and saplings may indicate differences in sugar content or volumes of sap available. So far as is known there is no connection between these black-barked sprouts and black-barked trees attacked by sapsuckers. None of the latter showed evidence of having originated as sprouts.

Seams or Cracks

Several sugar maples of sawtimber size were located which had rather limited blackening around seams or cracks. No sapsucker pecks were found on these trees. Other seams examined did not have black bark. It is possible that only those seams which develop new breaks in the cambium due to winter freezing release sufficient amounts of sap during the following spring to support the growth of black bark fungi (fig. 6).

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FIGURE 6. — Black bark below a spiral seam on a mature sugar maple. Repeated opening by freezing probably causes sap flow each spring.

Implications for Management in Lake States Northern Hardwoods

Bird peck is a log grade defect in factory logs. Lockard et al. (1963) and the Forest Products Laboratory (U.S. Forest Serv. 1959) have reported on its effect on logs and lumber.

The selection system of silviculture recommended for the northern hardwood type in the region (Arbogast 1957) has as its ultimate objective the maximum production of high-quality timber. High quality is developed through removal of low-quality trees of all size classes as well as overmature and mature trees at 8- to 15-year intervals. Sugar maples which have been heavily and repeatedly attacked by sapsuckers should be removed as soon as possible if they are not necessary in the stand because of considerations of spacing, stocking, etc. Such trees must be considered poor growing stock, and the growing space they occupy should be utilized by higher quality trees.

As mentioned previously, bird pecks are difficult to see, especially at the distances from which marking crews appraise individual trees. Such trees are probably often overlooked during marking. The black-bark indicator can serve as a warning that a closer inspection for bird peck is required. An appraisal of sapsucker damage can be made by grading the butt log, using hardwood log grades developed by the Forest Products Laboratory (U.S. Forest Serv., 1959). Because of the exceptions noted previously (porcupines, small rodents, etc.) it should not be used as an absolute indicator of bird peck but only as a warning sign of its possible presence. Other causes of black bark such as seams or rodent attack are more obvious and are probably not overlooked by marking crews.

Summary

Blackening on the lower bole of sugar maples is due to a fungus complex which includes *Fumago* sp., *Pullularia pullulans*, plus several as yet unidentified fungi growing together on the bark surface. They have dark mycelium and spores which, in mass, appear sooty-black to the unaided eye. Growth of the fungus complex has been observed following attacks by sapsuckers, porcupines, and small rodents. Limited areas of bark below some frost cracks also support the fungi. All of the incitants observed cause release of considerable sap having a relatively high sugar content which saturates the dead bark and provides a food base for the fungi.

Sapsucker attacks were responsible for nearly all black-barked sugar maples examined, the other incitants being relatively minor. The wound pattern, part of the tree attacked, and time of wounding by sapsuckers differ considerably from the usual sapsucker attacks on hardwood trees. Sapsucker attacks on the lower bole of sugar maples were concentrated almost exclusively on these black-barked individuals in the stands examined, and all such trees dissected showed evidence of heavy and repeated attack.

Bird peck is a log grade defect in factory logs and such trees should be removed from northern hardwood stands managed for high-quality timber in order to concentrate growth on higher quality trees. The black-bark indicator can serve as a warning of possible bird peck defect in sugar maples, indicating that close inspection for bird peck is required.

Literature Cited

Arbogast, Carl, Jr.
1957. Marking guides for northern hardwoods under the selection system. U.S. Forest Serv., Lake States Forest Expt. Sta., Sta. Paper 56, 20 pp., illus.

Boyce, John S.
1961. Forest pathology. 3rd ed. McGraw-Hill Book Co., New York. 572 pp.

Ellis, J. B., and Everhart, B. M.
1892. The North American Pyrenomycetes. Newfield, N.J. 793 pp.

Fraser, Lilian.
1933. An investigation of the sooty moulds of New South Wales. I. Historical and introductory account. Proc. Linnean Soc. New South Wales 58: 375-395.

Fraser, Lilian.
1937. The distribution of sooty-mould fungi and its relation to certain aspects of their physiology. Proc. Linnean Soc. New South Wales 62: 35-56.

Lockard, C. R., Putnam, J. A., and Carpenter, R. D.
1963. Grade defects in hardwood timber and logs. U.S. Dept. Agr. Handbook 244, 39 pp., illus.

Pearson, T. Gilbert, Editor.
1936. Birds of America. Garden City Publishing Co., Inc., Garden City, N.Y. 289 pp.

Roberts, T. S.
1936. Birds of Minnesota, Vol. I. Univ. Minn. Press, Minneapolis, Minn. 691 pp.

Shigo, Alex L.
1963. Ring shake associated with sapsucker injury. U.S. Forest Serv. Res. Paper NE-8, 10 pp. (Northeastern Forest Expt. Sta., Upper Darby, Pa.)

Sutton, G. M.
1928. An introduction to the birds of Pennsylvania. J. Horace McFarland Co., Harrisburg, Pa. 169 pp.

Taylor, Fred H.
1956. Variation in sugar content of maple sap. Vermont Agr. Expt. Sta. Bul. 587, 39 pp.

U.S. Forest Service, Forest Products Laboratory.
1959. Hardwood log grades for standard lumber. Forest Products Lab. Rept. D1737, 15 pp.

Wood, N. A.
1943. The birds of Michigan. Univ. of Mich., Museum of Zool. Misc. Publ. 75, 559 pp.

Some Recent Research Papers In the Lake States Station Series

Seed Stored in Cones of Some Jack Pine Stands, Northern Minnesota, by Eugene I. Roe. U.S. Forest Serv. Res. Paper LS-1, 14 pp., illus. 1963.

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The Causes of Maple Blight in the Lake States, by Lake States Forest Experiment Station. U.S. Forest Serv. Res. Paper LS-10, 15 pp., illus. 1964.

Identification of Hardwood Insects by Type of Tree Injury, North Central Region, by H. J. MacAloney and H. G. Ewan. U.S. Forest Serv. Res. Paper LS-11, 70 pp., illus. 1964.

The Identification of Primary Red Pine Cone Insects, by John S. Hard. U.S. Forest Serv. Res. Paper LS-12, 10 pp., illus. 1964.

Guide for Selecting Superior Trees for Shelterbelts in the Prairie Plains, by David H. Dawson and Ralph A. Read. U.S. Forest Serv. Res. Paper LS-13, 22 pp., illus. 1964.

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